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EXAMINER

GAKH, YELENA G

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| ART UNIT | PAPER NUMBER |
|----------|--------------|

1743

DATE MAILED: 01/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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|------------------------------|--|--------------------------------------|--|
| Office Action Summary | Application No. 10/009,704 | Applicant(s) WALKER ET AL. | |
| | Examiner Yelena G. Gakh, Ph.D. | Art Unit 1743 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 December 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 10-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 10-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Amendment filed on 12/03/04 is acknowledged. Claims 10-25 are pending in the application.

Response to Amendment

2. The amendment does not overcome the objection to the specification and rejection of the pending claims.

Specification

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. The specification is amended in part, which makes the terminology of the specification even more confusing, since different definitions are used for the same features. For example, in the Summary of Invention a cryogenic liquid absorption spectrum is disclosed as having a first reference energy, and the spectrum of impurity in the sample as having a second reference energy, the terminology already indicated in the previous Office actions as being unacceptable. In the amendment to the specification the spectrum of the pure cryogenic liquid now is disclosed as having a plurality of wavelengths that correspond to a first reference. What plurality of wavelengths is meant here? The examiner has already indicated, that any spectrum has a continuum of wavelengths, and therefore any spectrum comprises a plurality of wavelengths. It is completely unclear to the examiner, why the Applicants cannot use conventional terminology when describing spectra of cryogenic liquid and impurities, as containing characteristic absorption peaks at specific wavelengths for the cryogenic liquid and the impurity? Moreover, in the amended specification a superposition of two independent spectra seems to be disclosed,

as “sample spectra” (a plurality of spectra?) include “an energy spectrum associated with the cryogenic liquid and a target impurity energy spectrum associated with the target impurity”. To obtain superposition of two spectrum a special mathematical treatment of the spectra is required, which is nowhere disclosed in the specification. If the inventors actually meant “signals” or “peaks” associated with cryogenic liquid and the impurity, rather than “spectra”, then they should have said this. Each of three liquids disclosed in the specification, the cryogenic liquid, the impurity, and the sample comprising both cryogenic liquid and the impurity, have their own spectrum. One cannot “contain” the other. The spectrum of the sample may contain peaks of both cryogenic liquid and the impurity. The combination of the peaks of the cryogenic liquid and the impurity is **one** spectrum. It is not clear, what does the phrase at the end of the page 2 of the Amendment means: “The sample absorption spectra (a plurality of spectra?, *Ex.*) are then compared to the stored absorption spectra via the processing means 54 to distinguish among (?) and identify the cryogenic liquid sample absorption spectrum associated with the target impurity”? This sentence does not make any sense.

Further, the specification discloses a method directed to identifying and quantifying impurities. However, in the amended specification the known impurity is measured in its pure state in order to be detected in the sample. This contradicts the essence of the method, since no identification can occur, if the impurity is *a priori* known.

Formula given on page 4 is completely unapparent. Is this the formula deduced by the inventors, or is it a known formula? If this is a known formula, the corresponding reference, which describes it, is required. In description of the system of the invention on the same page very clear and correct terms are used for describing the same subject matter, i.e. measuring “absorption intensities” in IR spectra of the reference cryogenic liquid, reference impurity and cryogenic sample having this impurity. The examiner would like to emphasize again that the absorption energy of molecules (not the spectrum!) and intensity (or power) of light are not synonyms; they are defined clearly and unambiguously in the art, see e.g. “Fundamentals of Spectrophotometry” in “Quantitative Chemical Analysis” by Harris. It is well known to any routineer in the art that absorption energies define the origin of the molecule, specifically IR absorption energies define vibration states of the molecular functional groups, and have nothing to do with the concentration of the compound; at the same time intensities of the absorption lines

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(or changes in the light power, or transmittance) define the concentration of the compound. It is completely unclear, how dividing a frequency of one compound over the frequency of the other compound allows determining the concentration of the first one in the second?

Further, chemical compounds, i.e. contaminants or impurities, cannot be defined by their vibration energies (not mentioning incorrectness of such terminology) (page 6). Vibration energies are associated with specific bonds (e.g. C=O, or C-C, or C=C bonds), which can belong to numerous compounds. It is not clear, how any routineer in the art can determine, which compounds are considered impurities in the instant method by defining vibration energies of their bonds. It is only possible to determine, which bonds are present in the molecules. Such description does not give a clear and apparent description of the potential contaminants and is inappropriate for the disclosure, which, as it has already been stated lacks clarity in general.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 10-25 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The Nature of the Invention

The amended claims 10 and 18 are completely unclear and confusing and are not supported by the specification. First, it is completely unapparent, which method is recited in the claims, as it comprises measurement of absorption spectra of a cryogenic liquid and a “neat” impurity (which therefore should be *a priori* known), then providing a sample, which comprises “a second cryogenic liquid and a target impurity” (which therefore should be different from the

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first cryogenic liquid and the first impurity), measuring its spectrum (which should be different from the spectra of the first cryogenic liquid and the first impurity), and calculating the content of the target impurity in the second cryogenic liquid by using the spectra of the first cryogenic liquid and the first impurity. This method is completely non-understandable and un-enabled.

The mathematical expression relating the concentration of the impurity to the logarithm of the ratio of “target energy reference” and “first reference” is different from the one disclosed in the specification and is completely unclear. The examiner does not recall any reference on IR spectroscopy with such formula. Corresponding reference is required.

The State of the Prior Art and the Level of Predictability in the Art

Moulson (Nuclear Instruments) teaches “monitoring of dopant and impurity concentrations in liquid argon by infrared spectroscopy” (Title) by measuring IR spectra of cryogenic argon (Figure 2), an impurity (volatile organic compound having CH bond, ethylene) alone (Figure 3a) and impurity in the cryogenic liquid (Figure 3b) in a spectrum range 400-4000 cm^{-1} (2500-250 nm) (Figures 1-3) in a flow cell with a pressure drop between 0.85-1.05 bar ($\sim \text{lb/in}^2$) (page 278, right column) and confirming the presence of the impurity by comparing the spectrum with the reference spectra of pure argon and ethylene. “The cell was originally designed to be combined with a detector used to study the ionization characteristics and electron mobilities of doped liquid argon solutions [7], so that IR analysis of the solutions could be performed *in situ*” (i.e. on-line) (pages 277-278). Moulson teaches all the steps of the claims using conventional terminology of the art, i.e. reciting signal intensities in the spectra. He does not calculate concentration of the impurity as logarithm of the ratio of the target energy reference and the first reference, which are completely unclear terms. As it was indicated above, none of the textbooks on spectroscopy known to the examiner refers to such expression. The only expression that uses logarithm of the ratio of intensities (or power) of the light to find concentration of the absorbing compound is a well-known Beer’s law. As it was mentioned before, the terms “absorption energy of the molecules” and “intensity (or power) of light” are not synonyms. The absorption energies define the origin of the molecule, specifically IR absorption energies define vibration states of the molecular functional groups, and therefore are specific for

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specific functional groups; they have nothing to do with the concentration of the compound. The concentration of the compound is determined by the intensities of the absorption lines (or changes in the light power, or transmittance) of the compound. The prior art does not teach or predict quantitative analysis based on IR spectroscopy using the formula recited in the claims.

Claims 16 and 24 recite compounds defined by their vibration frequencies in nm. As it was indicated above, vibration energies are associated with specific bonds (e.g. C=O, or C-C, or C=C bonds), which can belong to numerous compounds. It is not clear, how any routineer in the art can determine, which compounds are considered impurities in the instant method by defining vibration energies of their bonds. It is only possible to determine, which bonds are present in the molecules. Such description does not give a clear and apparent description of the potential contaminants and is inappropriate for the disclosure, which, as it has already been stated lacks clarity in general.

The Existence of Working Examples

The working examples refer to measuring "absorption intensities" in IR spectra of the reference cryogenic liquid, reference impurity and cryogenic sample having this impurity and determining the amount of the impurity from these intensities. This is a conventional way of detecting impurities in the sample using IR spectroscopy by subtracting background spectrum of the reference compound. It has nothing to do with the expression disclosed in the specification and recited in the claims. There are no working examples for the subject matter recited in the pending claims.

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

8. Claims 10-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The amended claims 10 and 18 are completely unclear and confusing and are not supported by the specification. First, it is completely unapparent, which method is recited in the

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claims, as it comprises measurement of absorption spectra of a cryogenic liquid and a “neat” impurity (which therefore should be *a priori* known), then providing a sample, which comprises “a second cryogenic liquid and a target impurity” (which therefore should be different from the first cryogenic liquid and the first impurity), measuring its spectrum (which should be different from the spectra of the first cryogenic liquid and the first impurity), and calculating the content of the target impurity in the second cryogenic liquid by using the spectra of the first cryogenic liquid and the first impurity. This method is completely non-understandable. Moreover, recitation of the second cryogenic liquid is not supported by the specification; the second cryogenic liquid is not defined anywhere in the disclosure and therefore renders the claims unclear and indefinite.

The expressions “first (or second) energy spectrum comprising a first (or second) plurality of wavelengths” are not clear, as each spectrum is a continuous range of the wavelengths. It is not clear, what does it mean, “sample energy spectra including said first energy spectrum and a target impurity energy spectrum”? How many “sample energy spectra” are measured? The sample energy spectra cannot include the first energy spectrum and a target impurity energy spectrum, since they are all independent spectra. Moreover, how can the spectrum of the sample, comprising the second cryogenic liquid” include” the spectrum of the first cryogenic liquid?

Why should the identity of the target impurity be determined, if the method comprises “providing a cryogenic liquid sample comprising a second cryogenic liquid and a target impurity”, which means that the target impurity is present and known?

The mathematical expression in claims 10 and 18 is different from the one disclosed in the specification and is unclear. What exactly are “target energy reference” and “first reference”? Are they the plurality of wavelengths and therefore a set of numbers? Then how can this equation be solved? The examiner is not aware of any analogs of this equation in the art and therefore requests a reference, which discloses a similar equation.

The terminology used by the Applicants in the specification and claims completely contradicts accepted terminology in the art and makes the disclosure unclear, indefinite, and confusing.

Claims 16 and 24 recite “a material having molecules that exhibit a vibration energy in the range of approximately 1000 nm to 250 nm”. Chemical compounds, i.e. contaminants or impurities, cannot be defined by their vibration energies. Vibration energies are associated with specific bonds (e.g. C=O, or C-C, or C=C bonds), which can belong to numerous compounds. It is not clear, how any routineer in the art can determine, which compounds are considered impurities in the instant method by defining vibration energies of their bonds. It is only possible to determine, which bonds are present in the molecules. Such description does not give a clear and apparent description of the potential contaminants and is inappropriate for a disclosure, which, as it has already been stated lacks clarity in general

Response to Arguments

9. Applicant's arguments filed 12/03/04 have been fully considered but they are not persuasive.

The examiner believes that the extensive excerpts from the examiner's own Office action cannot be considered an adequate response to the objection and rejections established in the Office actions. The Applicants failed to provide any reference, which would explain the equation recited by the Applicants in the claims, which now is different from what is disclosed in the specification, but equally unclear.

The Applicants amended only a part of the specification, which makes it even more confusing, since different terminology defines the same subject matter.

The major portion of the Applicants' remarks, which *are* the Applicants' remarks, rather than the recitation of the examiner's Office action, is directed toward §102 rejection, which is not even an issue for the present case. In order for the claims to be rejected over the prior art, they should be first represented in a clear manner. The examiner indicated that the claims, especially newly amended claims, are so unclear, that it is difficult to understand the subject matter they recite. Therefore, it is impossible at this stage to apply any prior art to the claims. However, if the examiner's tentative guess on the essence of the invention is correct, it is fully covered by the Moulson's reference. As it was already indicated, NIR spectroscopy is a part of IR spectroscopy, and Moulson discloses the method of IR measurement of impurities in the cryogenic liquid using a flow cell for *in-situ* analysis. However, as it was already indicated, the

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rejection over the prior art was not an issue in the previous Office action, and none of the issues that were raised in the previous Office action were answered by the Applicants, including failure to submit any reference disclosing the formula recited in the claims.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yelena G. Gakh, Ph.D. whose telephone number is (571) 272-1257. The examiner can normally be reached on 9:30 am - 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill A. Warden can be reached on (571) 272-1267. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Yelena G. Gakh
1/13/05

